National Aeronautics and Space Administration

X-tra

A special publication of the NASA Dryden Flight Research Center X-Press, Edwards, California

Fiesta

NASA aeronautics, technology on display at New Mexico's International Balloon Fiesta

This page, *hot air balloons take to the skies during a mass ascension. (NASA Photo ED08 0254-039 by Tony Landis)*

Cover, *Balloons light up for the Balloon Glow, as a New Mexico moon appears from behind the clouds. (NASA Photo ED08 0254-095 by Tony Landis)*

NASA at the Fiesta

Agency celebrates 50th anniversary with 800,000 at balloon fest

By Jay Levine
X-Press Editor

Many brisk, dark mornings at the Albuquerque, N.M., International Balloon Fiesta transitioned to sunny ones as brightly colored hot air balloons ascended en masse to the skies.

More than 800,000 people attended the events during the week to see 621 hot air balloons. There were 208 launch sites capable of sending off two consecutive waves of hot air balloons. Because of the number of hot air balloons, multiple waves were required to get them all airborne. To give a reference for the size of the Balloon Fiesta acreage, imagine 56 football fields lumped together.

So what did some of the fans do when the action was over, or at least out of sight? They headed to exhibits like NASA's, which was available all nine days of the event that wrapped up Oct. 12, despite a soggy Sunday morning and pockets of inclement weather during the event.

Visitors to the Balloon Fiesta saw a NASA exhibit focused on aeronautics, said Mary Ann Harness, Dryden public outreach specialist and exhibit coordinator.

"We were looking to portray aeronautics to folks so they realized NASA isn't just [about] space," Harness said. "We also stressed NASA's 50th anniversary, as well as featured SOFIA, a timeline of aeronautics, and how different aircraft – military, commercial and general aviation – have benefited from NASA technology efforts."

For Marcos Gonzales, at least, and his daughter Renata, 5, that message came through loud and clear.

While Renata was sitting in a T-38 simulator cockpit, Gonzales said he has been to Edwards Air Force Base and seen the sleek Mach 3 Blackbird. He has passed his love of aviation to his daughter.

Dad and daughter also had an appreciation for the Stratospheric Observatory for Infrared Astronomy, or SOFIA aircraft. Information about the SOFIA program was available at the exhibit, which fired the Gonzales' imaginations because of one of their hobbies.

"We have a telescope and binoculars at home and we look at the constellations. We also watch news on NASA missions," Mendoza said.

The SOFIA is a specially modified NASA 747 that will carry the world's largest airborne infrared telescope, which was built by Germany, a key U.S. partner in the venture. Darlene Mendoza, who is based at NASA Ames Research Center, Moffett Field, Calif., showed attendees an infrared camera and the differences between what can be viewed in visible versus infrared light.

ED08 0254-068 **NASA Photo by Tony Landis**

Sitting in a T-38 simulator gave visitors to the NASA exhibit a feel for an aircraft cockpit.

ED08 0254-076 **NASA Photo by Tony Landis**

NASA's Darlene Mendoza shows a visitor to the SOFIA exhibit what she looks like through the lens of an infrared camera.

The infrared camera used in the SOFIA exhibit was of special interest to Arabella Pepin, who said she is considering a career in engineering.

"It was very interesting seeing myself on the screen, and it helped me see what my science teacher in eighth grade taught me about infrared light," she said. "I thought it was interesting how a regular airplane was transformed into a laboratory that scientists will be able to use to see things in ways they could not see them before."

Assisting Harness in staffing the NASA exhibit was Kimberlee Buter, and representing Dryden's Innovative Partnerships Program office was Dryden's Kim Lewis-Bias. Lewis-Bias provided materials that showcase ways in which NASA technology may be found in everyday life and in all varieties of aircraft.

The Balloon Fiesta exhibit emphasis on NASA's anniversary year coincided with the week on which the agency began business as NASA. On Oct. 1,

See NASA exhibit, page 8

Up, up and away

By Jay Levine
X-Press Editor

If you saw a frosty beer followed by a pink elephant, blue dragon, an astronaut in a spacesuit, a flying cathedral and Darth Vader, you might think you've been working too hard and need a vacation.

In fact, you might have been a spectator of the Albuquerque, N.M., International Balloon Fiesta. About 621 hot air balloons representing 24 countries and 42 U.S. states attracted about 800,000 visitors during the nine-day event that wrapped up Oct. 12. The event had something to offer any fan of the unusual airships, as an army of more than 1,000 volunteers helped make the event fly.

Some of the other eye-catching and unusual balloon shapes included a cow-shaped balloon representing a dairy, Humpty Dumpty, Wally the Clown Fish (he looks like a relative of Disney's Nemo), a watermelon, and bees that were holding hands – two separate but connected hot air balloons. There also was a seemingly endless supply of multi-colored hot air balloons with rainbow colors and unusual patterns.

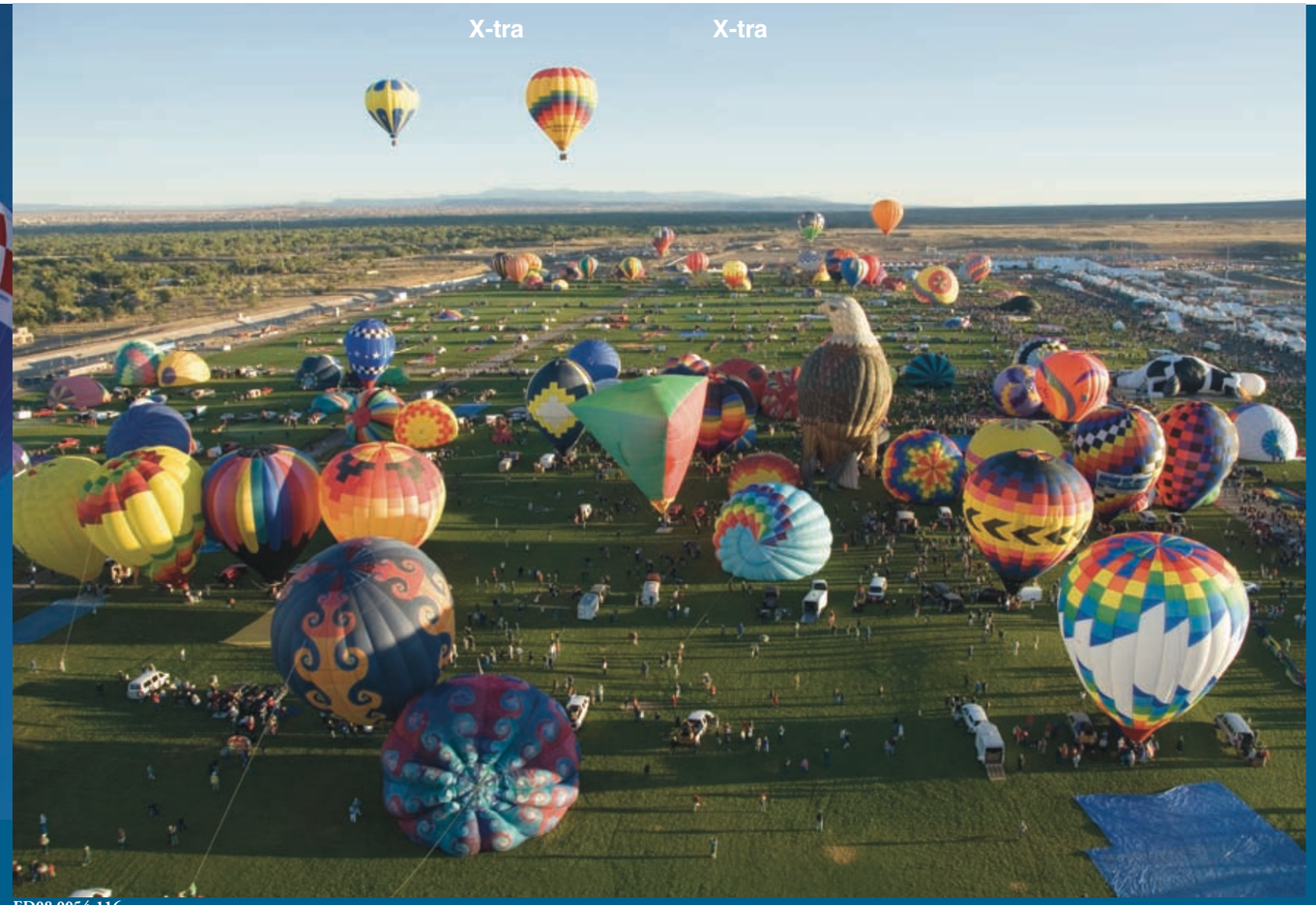
Preparation

The warm, orange glow of crackling propane brightened the darkness as hot air balloons ascended early on the opening Saturday morning of the event. Hundreds of thousands of people saw about a dozen balloons that comprised a "Dawn Patrol" light up the first event. The "Dawn Patrol" was a warm-up to the opening day mass ascension of hot air balloons.

Standing on the field, people saw bright, flattened canvases – commonly referred to as a bag, or envelope – moving under pressure of gas-powered fans. The bag is constructed from reinforced fabric called rip-stop nylon, although polyester and other fabrics are sometimes used. The materials are lightweight and strong and coated on the inside to prevent leaks. The fabric toward the lower portion of the hot air balloon is a fire-resistant material similar to Nomex, which is used by fire fighters and racecar drivers.

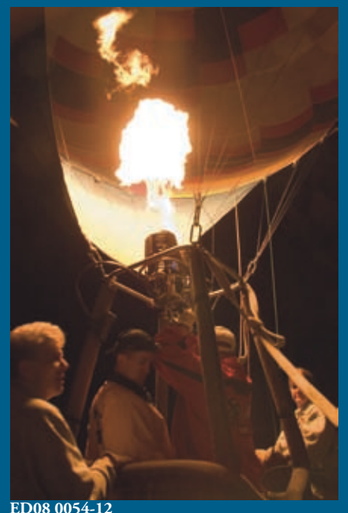
The bag was flattened and spread out, usually by crews of four or more people, and attached to the wicker basket that carried the hot air balloon's crew. The basket was on its side until inflation, to allow the crew to board it.

Once the gas fan completed its job, the propane burner was lit and as it warmed the air inside the bag, the balloon began to rise. The smell of the propane permeated the field, while the flame also warmed people



ED08 0054-116

***Above**, NASA photographer Tony Landis captured this image of a mass ascension from his post in a hot air balloon. **Below left,** propane flames heat the air inside a hot air balloon to prepare it for flight. The photos below and right show another mass ascension view and some unusual hot air balloons that were on display at the Fiesta.*



ED08 0054-12

ED08 0054-026

ED08 0054-116

NASA Photos by Tony Landis

ED08 0054-35

ED08 0054-143

standing within 20 feet. The sound of the propane flame was like that of the ocean washing up on the shore.

The multi-colored behemoths expanded to about 70 feet high when fully inflated and then the hot air balloons were ready for launch. The hot air balloons were right next to each other, seemingly pushing and straining against each other for space until one balloon became fully inflated and rose above the other hot air balloons to claim a piece of sky.

Ready to fly

Just as the balloon is fully inflated and ready for launch, skilled crews steadied the wicker basket in which people travel into the sky. Other crewmembers held onto ropes that tethered the aircraft to the field until the crew climbed aboard and the aircraft was ready for departure.

Most hot air balloon flights are between 500 and 1,000 feet high and depending on how much fuel is onboard and the number and weight of people, the average flight is about two hours. The hot air balloons essentially go where the winds blow them, but at different altitudes winds blow in different directions. That gives the pilot an opportunity to take the aircraft in the direction he or she had chosen.

Once the aircraft landed, the chase crew came to round up the crew and pack up the balloon. The chase crew includes people in a vehicle that follow the aircraft from the takeoff spot to the place the aircraft has landed. Directions to the chase crew usually are given from the pilot in the sky, who can see the best routes to follow.

A number of activities

Rain brought moisture, but it didn't dampen enthusiasm for the event. Despite rain on the second day of the festivities and intermittent gusts that led to cancellation of some events on Monday, fans had other things to keep them occupied until better weather allowed hot air balloons to resume flights.

In a carnival-like atmosphere, 170 concessions including 45 food and 105 merchandise vendors were arranged along the eastern edge of the field. Ranging from breakfast burritos and tasty treats to Balloon Fiesta pins, shirts and posters and psychics, there were a number of things for event attendees to see.

Another unusual activity was the chainsaw woodcutting contest. As the name would (wood) imply, people started with huge hunks of wood and carved them into pieces of art. Car shows, concerts and fireworks also were on the schedule.

History lesson

The Balloon Fiesta began in 1972 with 13 hot air balloons that launched near a popular Albuquerque shopping center.

This year's 37th annual Balloon Fiesta marked the 225th anniversary of the first hot air balloon flight and the 30th anniversary of the historic first trans-Atlantic flight by the Double-Eagle II, flown by Ben Abruzo Maxie Anderson and Larry Newman. The Double-Eagle II, a Helium hot air balloon, was aloft for 137 hours and six minutes. It departed from Presque Isle, Maine, and landed in Miserey, France, near Paris.

The Balloon Fiesta also captured a Guinness World Record in 2000, when 1,016 hot air balloons took off from the event, marking the most hot air balloon launches in a set time frame.

Inspiring

NASA visit to school sparks student interest

By Jay Levine
X-Press Editor

How cool is NASA when students in two fifth grade classes forgo recess to ask more questions?

For Gary Sandberg and Robert Doyle's two Cielo Azul Elementary School classes in Rio Rancho, N.M., studies Oct. 7 included some lessons on NASA aeronautics. Delivering the information were three NASA representatives.

"NASA is about space, but it's also about aeronautics," said Mary Ann Harness, public outreach specialist and exhibit coordinator at Dryden. In fact, the three NASA representatives were in Albuquerque, N.M., to provide NASA aeronautics information to attendees of the Albuquerque International Balloon Fiesta.

Students knew about the space shuttles and NASA's space mission and they were equally enthusiastic to learn about the agency's airplanes.

That enthusiasm grew when Dryden life support technician Jim Sokolik asked students about the high-altitude pressure suit he brought with him. Students watched as Sokolik instantly inflated the suit with a pump and explained how the lack of oxygen and pressure 11 miles up would cause pilots to pass out without suits like the one he brought with him.

At Dryden, ER-2 pilots must wear such suits to survive in the harsh environment of high-altitude flight. The ER-2 is the civil variant of the military U-2 reconnaissance aircraft. NASA's ER-2 aircraft are used for environmental sampling and atmospheric observation missions.

"The pilot flying the aircraft in the pressure suit is like you wearing your winter clothes to ride your bicycle," he further explained.

Students asked him about what people eat at high altitude and how the pilot gets to it. A hole in the side of the helmet with a spring-loaded valve allows a straw to be inserted. Drinking is by straw and food is "eaten" from a tube that students were allowed to try.

ED08 0254-104 NASA Photo by Tony Landis

Above, *Dryden life support technician Jim Sokolik explains how a pilot's high-altitude pressure suit works to students in two fifth grade classes at Cielo Azul Elementary School in Rio Rancho, N.M.* ***Below****, Mary Ann Harness, left, squeezes some pudding from the kind of tube used by high-altitude pilots as Reneé Harness, center, looks on.*

"This is chocolate pudding and it has plenty of sugar," Sokolik said.

Students appeared to like the brown substance that oozed from the silver tube.

He explained the suit is made of a fire retardant material called Nomex and that a white mesh underneath is used to customize the suit for each pilot.

"They knit this mesh together, just like your grandma does," Sokolik joked.

Excellent student questions earned a special life support patch, such as the one Anthony Alvarado asked.

"Why is there a little ball in the front of the suit?" Anthony asked.

"When the suit inflates it generates a lot of energy. Even if they can't see because the force of the inflation pushes the helmet to a position they can't see, they can find the golf ball for the helmet adjustment. The glove inflates too and they might not even be able to easily feel the golf ball, but they know it's there," Sokolik answered.

ED08 0254-105 NASA Photo by Tony Landis

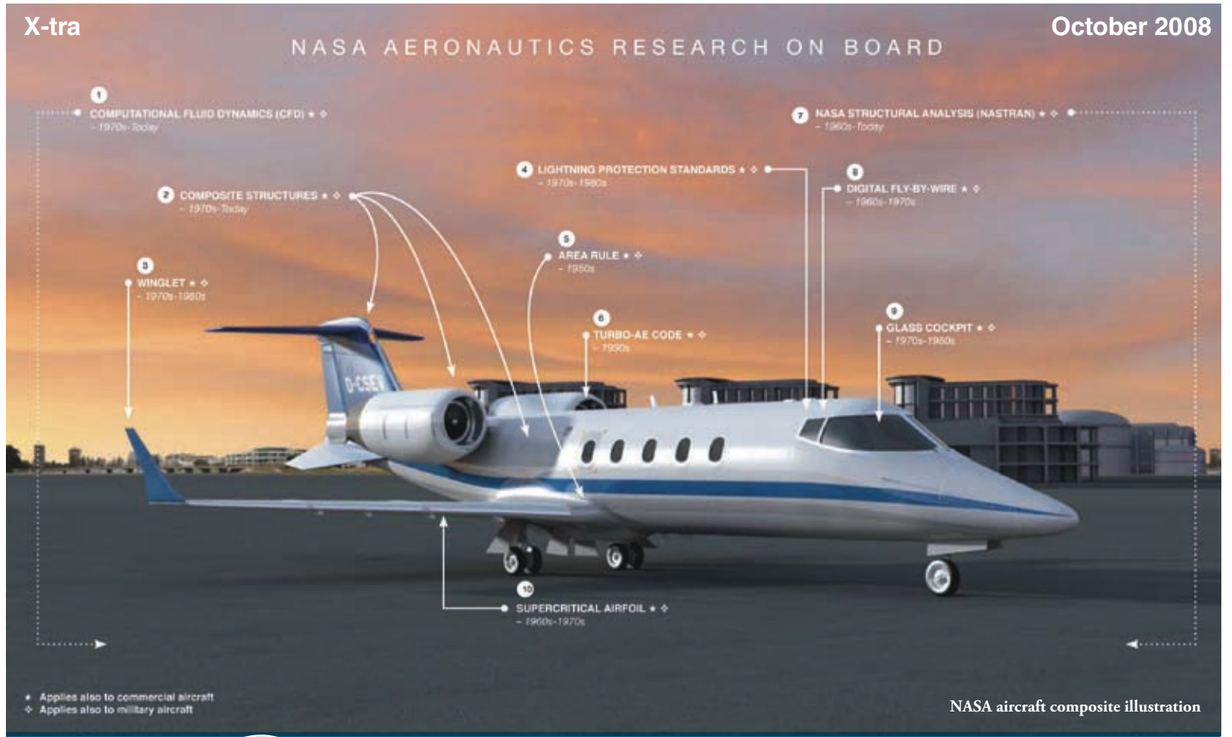
Maria Verdoren also earned a patch by asking what happens to air already in the helmet when the suit inflates and gives oxygen to the pilot. Sokolik explained the suit and helmet were separate elements and the air in the helmet is sucked out as the fresh oxygen is pumped into the helmet.

Darlene Mendoza, who is based at Ames Research Center, Moffett Field, Calif., rounded out the group of speakers. She gave a brief overview of the Stratospheric Observatory for Infrared Astronomy program. The SOFIA aircraft is a specially modified NASA 747 that will carry the world's largest airborne infrared telescope, which was built by Germany, a key U.S. partner.

"What happens if they run out of energy?" asked Valerie Harness.

Mendoza explained the aircraft can return to Earth if it encounters challenges and can go back to complete the mission.

What appears unlikely to run out of energy is the students' newfound enthusiasm for aeronautics.



NASA aircraft composite illustration

NASA Technology

Compiled from NASA News Services

NASA's centers individually and in combination have developed technology that has had big impacts on general aviation, commercial and military aircraft. The following 10 technologies are examples:

1. Computational fluid dynamics – During the 1970s, NASA developed sophisticated computer codes that could accurately predict the flow of a fluid using complex simulations, such as air over an aircraft's wing or fuel through a space shuttle's main engine.

Those codes became computational fluid dynamics, or CFD, which today is considered a vital tool for the study of fluid dynamics. CFD greatly reduces the time required to test and manufacture nearly any type of aircraft.

2. Composite structures – NASA first partnered with private industry during the 1970s to conduct research on how to develop strong, nonmetallic materials that could replace heavier metals and aluminums on aircraft.

Composite materials have gradually replaced metallic materials on parts of an aircraft's tail, wings, fuselage, engine cowlings, and landing gear doors. Using composite materials can reduce the overall weight of an aircraft and improve fuel efficiency.

3. Winglets – During the 1970s and 1980s, NASA studies led to the development of vertical endplates, or "winglets," that are now seen on many aircraft wings. This innovation is the first of three efforts on this list that were led by NASA Langley Research Center's pioneering scientist Richard Whitcomb, who was chief of the Transonic Aerodynamics Branch at Langley in Hampton, Va.

Winglets reduce vortices and drag, thereby improving airflow and fuel efficiency. The first aircraft to adopt winglets were within the general aviation and business jet communities. In the mid-1980s, Boeing produced the 747-400 commercial jetliner, which used winglets to increase its range.

A winglet flight test program at the NASA Dryden Flight Research Center, Edwards, Calif., in 1979-80 first validated Whitcomb's research when the test aircraft – a military version of the Boeing 707 jetliner – recorded an increased fuel mileage rate of 6.5 percent.

4. Lightning protection standards – During the 1970s and 1980s, NASA conducted extensive research and flight tests to identify the conditions that cause lightning strikes, the types of currents, and the levels of threat.

The research confirmed the data that were incorporated into design guidelines that are used in new aircraft and in flight operations to protect critical digital systems.

5. Area rule – In the 1950s, Whitcomb discovered one of the most revolutionary aeronautics technologies when he researched "area rule," a concept that helped aircraft designers avoid the disruption in airflow caused by the attachment of the wings to the fuselage.

See Technology, page 8

NASA exhibit ... from page 3

1958, the former National Advisory Committee for Aeronautics, or NACA, officially became the National Aeronautics and Space Administration. It's an anniversary NASA officials want to share.

"The Balloon Fiesta offered NASA a chance to spread the word on its aeronautics projects. The venue also provided another opportunity for NASA to share in the celebration of its 50th anniversary with more than 800,000 people," said Anthony Springer, NASA communication and education lead for the Aeronautics Research Mission Directorate.

Another part of the exhibit illustrated how pilots of high-altitude aircraft are protected from cold, thin air. Dryden life-support technician Jim Sokolik was on hand to demonstrate the suits' use to Fiesta crowds.

Sokolik also had on display a retired full-pressure suit assembly like those ER-2 pilots must wear to survive in the harsh environment of high-altitude flight. The ER-2 is the civil variant of the military U-2 reconnaissance aircraft. NASA's ER-2 aircraft are used for environmental sampling and atmospheric observation missions.

Brandon Clark, 8, was particularly interested in how pilots in high-pressure suits get a drink. Sokolik gave the boy a bottle with a long straw and had him poke it through a hole in the helmet.

"I learned that they can drink by sticking the straw through this hole," Clark said, pointing to a hole in the helmet.

Another popular part of the NASA exhibit was a photo booth where visitors could have pictures taken in an automated system that produced photos simulating the subject on the moon or on Mars.

Emily Anderson, a student at the University of New Mexico in Albuquerque, said the exhibit was "simply out of this world."

"I visited Mars and I have the photographic evidence. I'm doing a speech on astronautics and this will a good visual aid. It was my dream as a kid to be an astronaut and my dad works in aerospace," Anderson said.

And what is more appropriate than an inflatable half-scale F-18 at a balloon event? F-18 aircraft are used at NASA as research planes and for following research aircraft to provide support for the mission and a platform for photo and video documentation of research flights.

The NASA showcase also featured a T-38 cockpit simulator for visitors to sit in and get a feel for real jet aircraft as well as a continuous video presentation highlighting 60 years of flight research and testing at Dryden.

Technology ... from page 7

Whitcomb deduced that removing the equivalent wing cross-sectional area from that of the fuselage cross-sectional area avoided the abrupt bump and improved the distribution of flow across the longitudinal area of the aircraft. By using the area rule, aircraft designers for decades have been able to allow aircraft to fly higher, faster, and farther.

6. Turbo AE code – During the 1990s, NASA developed a computer code that generates two-dimensional simulations of potential aeroelastic problems that can occur in jet engine blades. Such problems include flutter or fatigue that can eventually cause engine fan blades to stall or fail.

With TURBO-AE, engineers can more efficiently design thinner, lighter, faster rotating blades for today's jet engines built for higher performance, lower emissions and lower noise.

7. NASA structural analysis (NASTRAN) – In the 1960s, NASA partnered with industry to develop a common generic software program that engineers could use to model and analyze different aerospace structures, including any kind of spacecraft or aircraft.

Today, NASTRAN is an industry-standard tool for computer-aided engineering of all types of structures.

8. Digital Fly-By-Wire – During the 1960s and 1970s, Dryden researchers developed and flight tested the digital fly-by-wire system, which replaced heavier and less reliable hydraulics systems with a digital computer and electric wires to send signals from the pilot to the control surfaces of an aircraft.

The F-8 Digital Fly-By-Wire flight research project in 1972-73 validated the principal concepts of all-electric flight control systems now used on nearly all modern high-performance aircraft and on military and civilian transports. It was the forerunner of current fly-by-wire systems used in the space shuttles.

9. Glass cockpit – During the 1970s and 1980s, NASA created and tested the concept of an advanced cockpit display that would replace the growing number of dial and gauge instruments that were taking up space on an aircraft's flight deck.

Called a "glass cockpit," the innovative approach uses flat panel digital displays to provide the flight deck crew with a more integrated, easily understood picture of the vehicle situation. Glass cockpits are in use on commercial, military, and general aviation aircraft, and on NASA's space shuttle fleet.

10. Supercritical airfoil – During the 1960s and 1970s, Whitcomb led a team of researchers to develop and test a series of unique geometric shapes of airfoils, or wing designs, that could be applied to subsonic transport to improve lift and reduce drag.

The resulting "supercritical airfoil" shape, when integrated with the aircraft wing, minimizes drag and helps improve the aircraft's cruise efficiency. Compared to a conventional wing, the supercritical wing is flatter on the top and rounder on the bottom with a downward curve at the trailing edge.

Results of the NASA flight research at what today is known as Dryden demonstrated that aircraft using the supercritical wing concept would have increased cruising speed, fuel efficiency (about 15 percent), and flight range over those using conventional wings. As a result, supercritical wings are now commonplace on virtually every modern subsonic commercial transport.

X-tra is published for civil servants, contractors and retirees of the Dryden Flight Research Center and the center's partners and civil customers.

www.nasa.gov

Address: P.O. Box 273,
Building 4839
Edwards, Calif. 93523-0273
Phone: 661-276-3449
FAX: 661-276-3566

Editor: Jay Levine, Tybrin, ext. 3459

Assistant Editor: Sarah Merlin, Tybrin, ext. 2128

Managing Editor: Steve Lighthill, NASA

Chief, Strategic Communications: John R. O'Shea